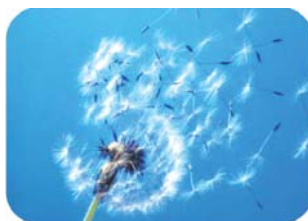
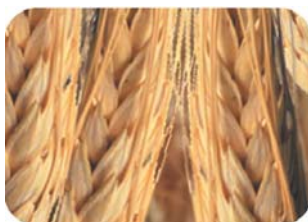


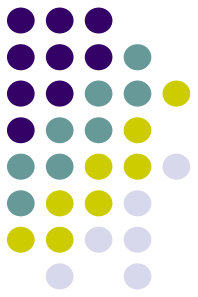
Leaders in Environmental Testing

## Emerging Technologies – Toxic Organics



**Advances in High-Volume Sampling and Trace Analysis of Persistent Organic Pollutants**

# Newark Bay Estuary Participants



- **United States Geological Survey (USGS-NJ)**
- **New Jersey Department of Environmental Protection (NJDEP)**
- **Stevens Institute - Rutgers University**
- **Severn Trent Laboratories**
- **Battelle Environmental Divisions**

# New Jersey Toxic Sediment Reduction Program

- Determine sources and concentrations of organic contaminants in the Newark Bay and Hudson River Estuary system.
- Detect as many target compound as possible.
- Obtain samples with target compounds in a range of magnitudes above field blanks and lab blanks.
  - >> High-volume multi-stage sampling train. Toxic Organics Platform Sampler (TOPS).

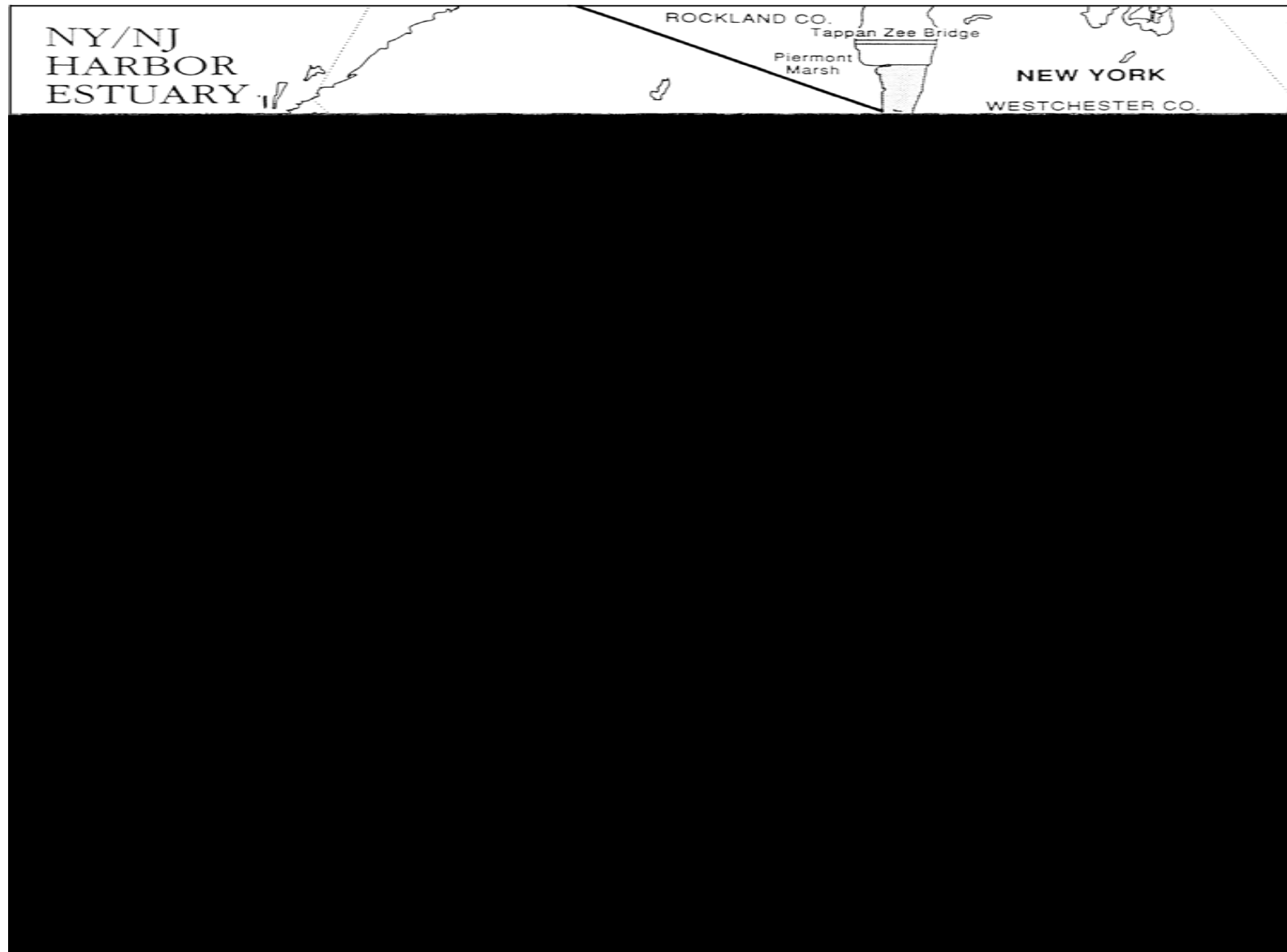
# Persistent Organic Pollutants (POPs) Studied

- Polychlorinated Dioxins and Furans (PCDDs/PCDFs) (17 analytes)
- Polychlorinated Biphenyls (PCBs) (113 analytes)
- Organochlorine Pesticides (OCPs) (24 analytes)
- Polynuclear Aromatic Hydrocarbons (PAHs) (27 analytes)

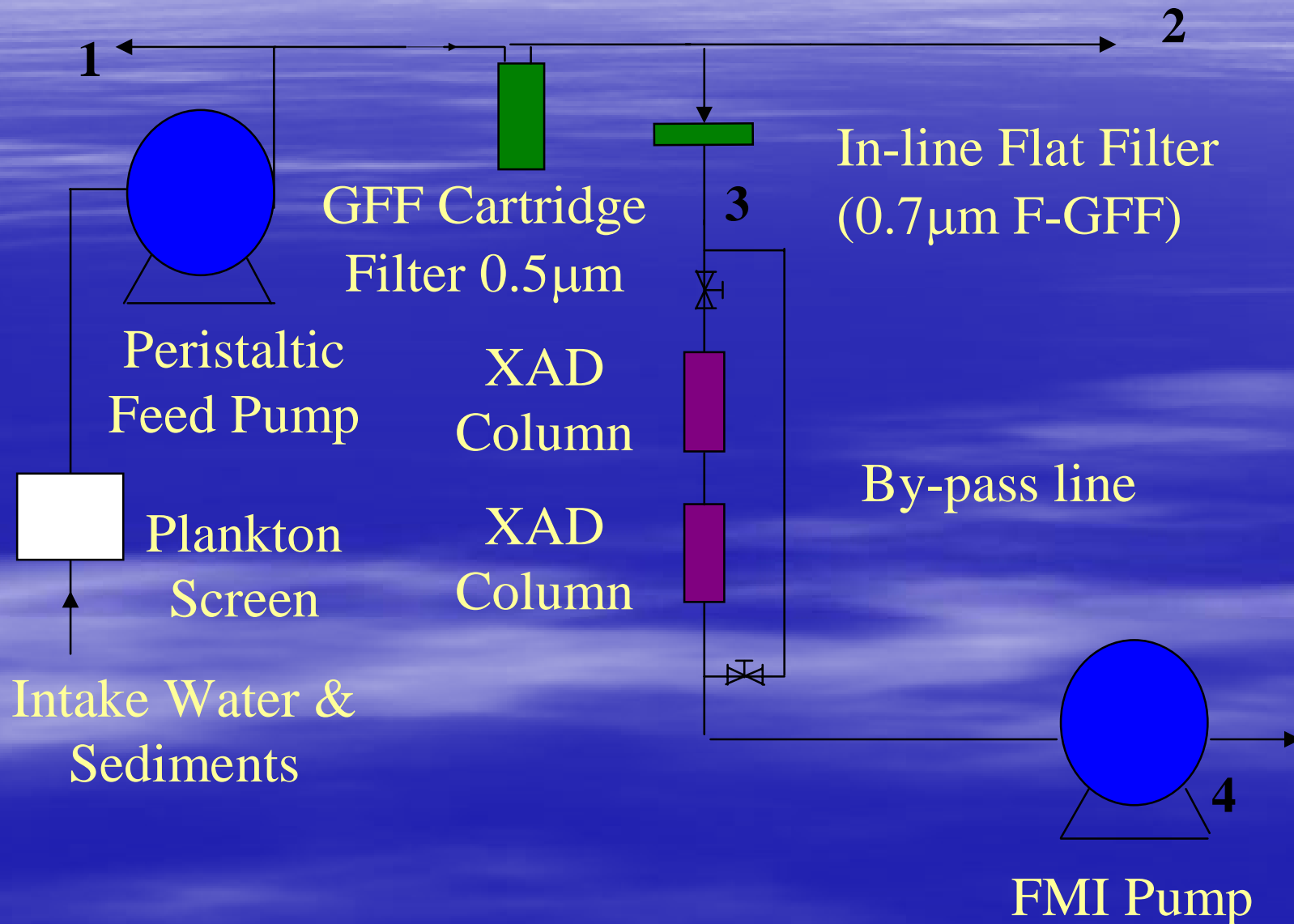
# New York / New Jersey Harbor Estuary

## Sampling locations:

- heads of tide,
- combined sewer outfalls
- mixed pools.



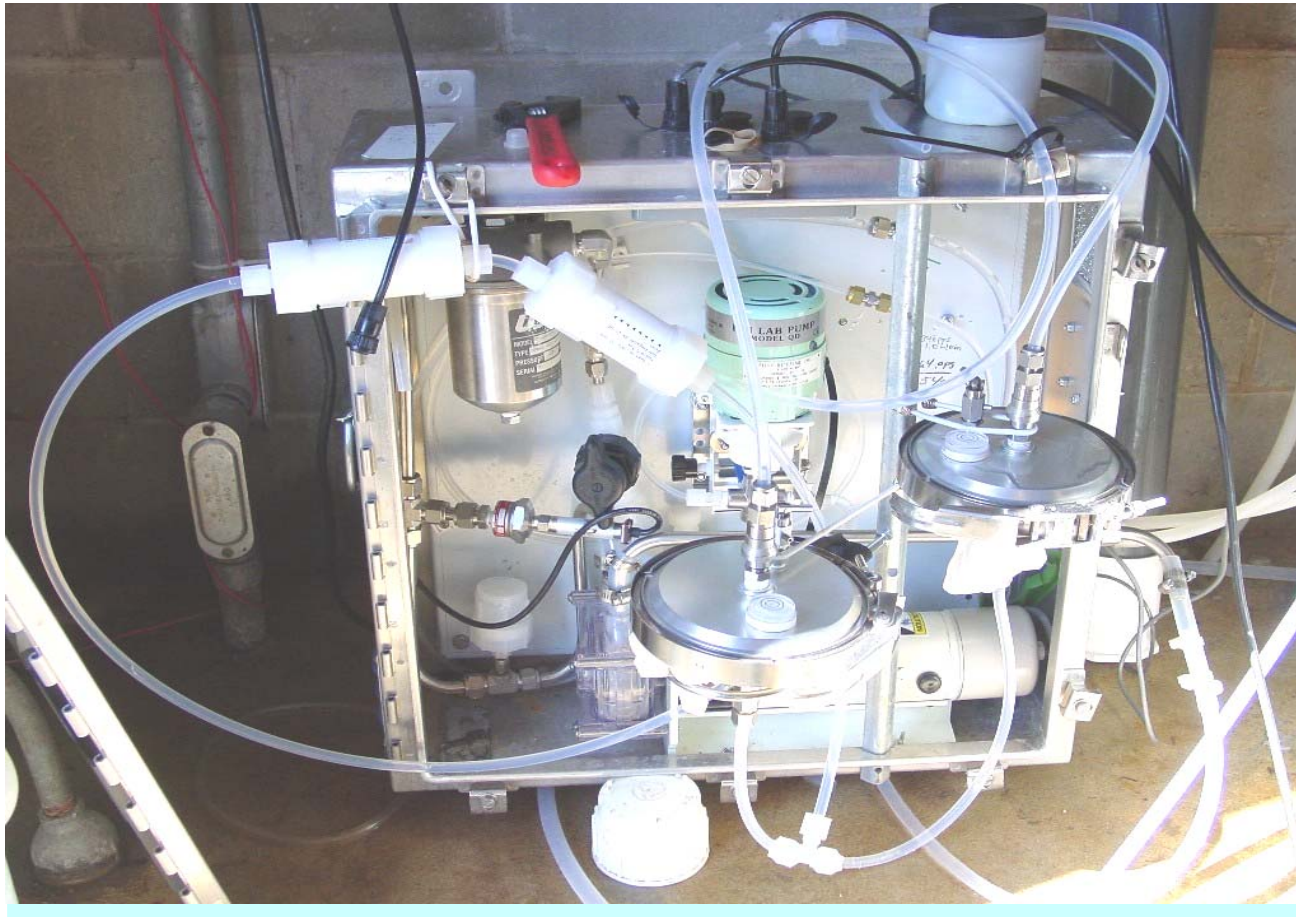
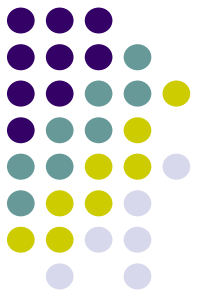
# Modified TOPS Sampler





# **TOPS Sampler**

Large volume sediment/water phase sampler  
using filters and XAD resin columns



# Filters



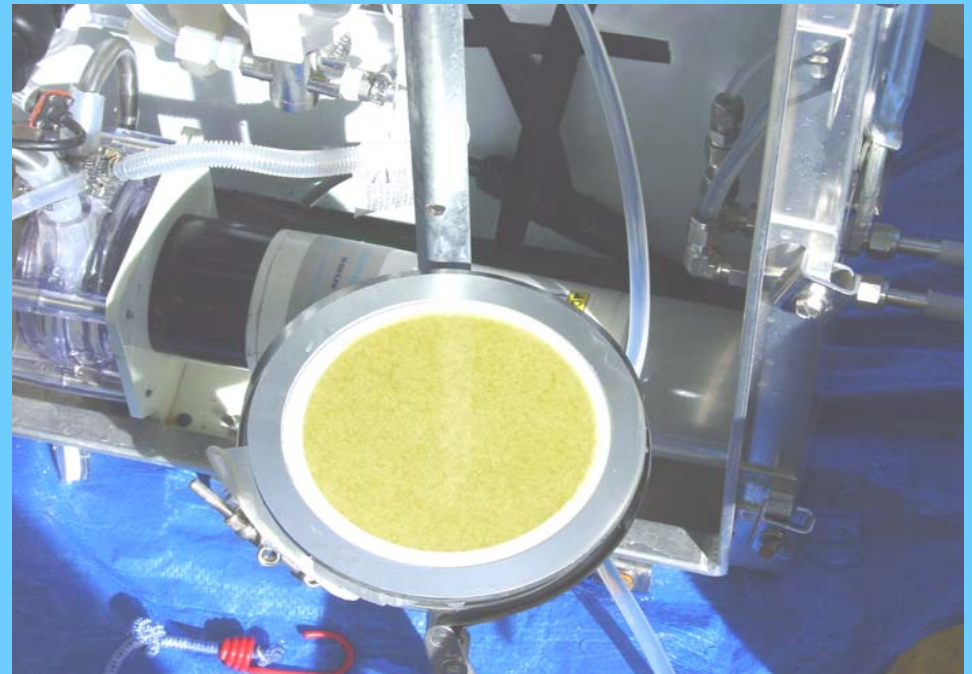
GFF Canister

↙ 4" in length  
0.5 micron,  
nominal pore  
size

Flat GF/F

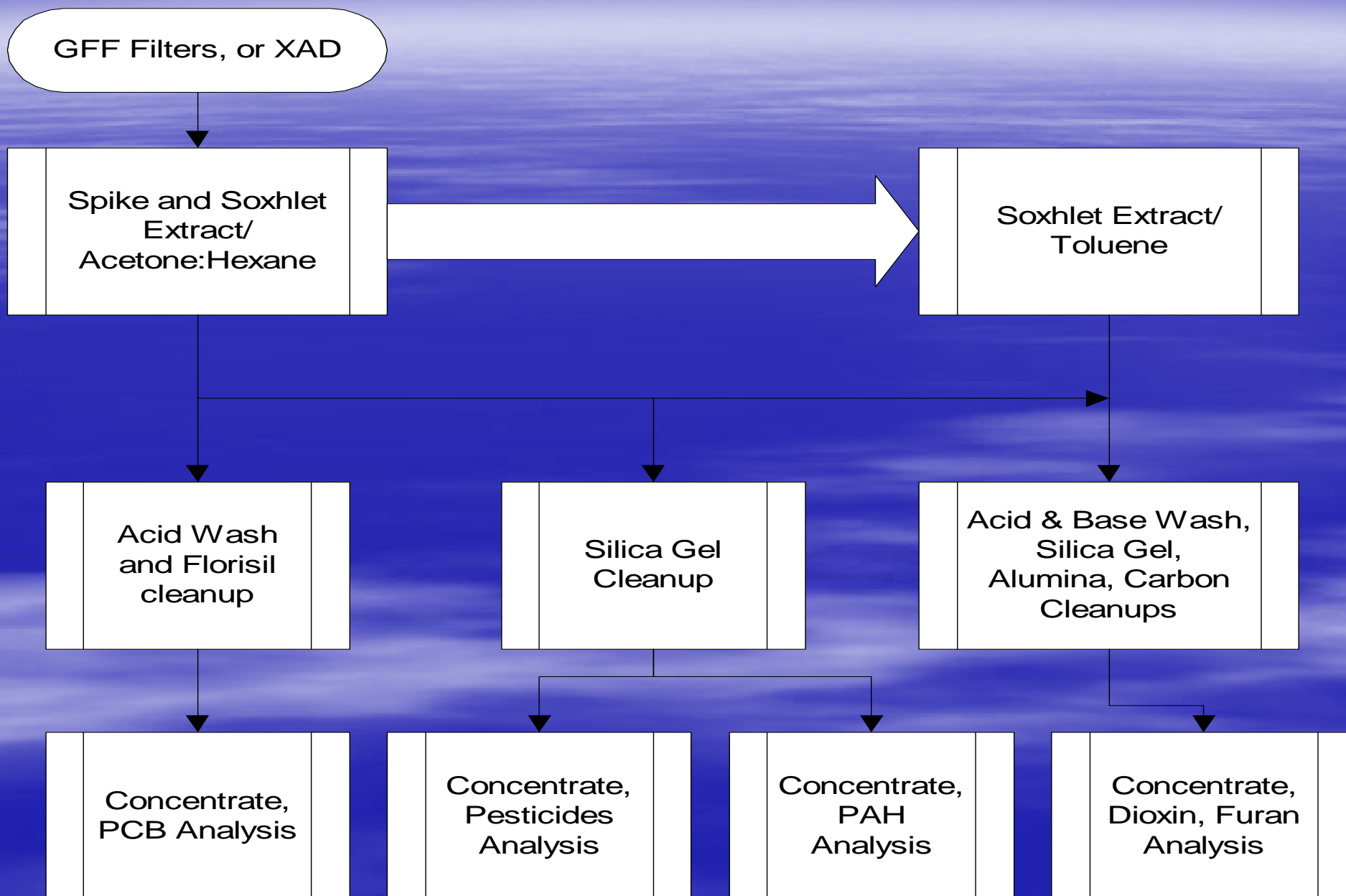
142 mm diameter

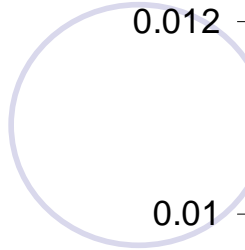
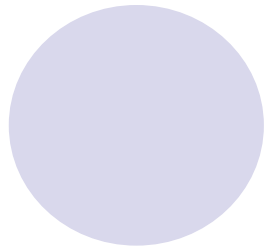
0.7 micron,  
nominal pore  
size





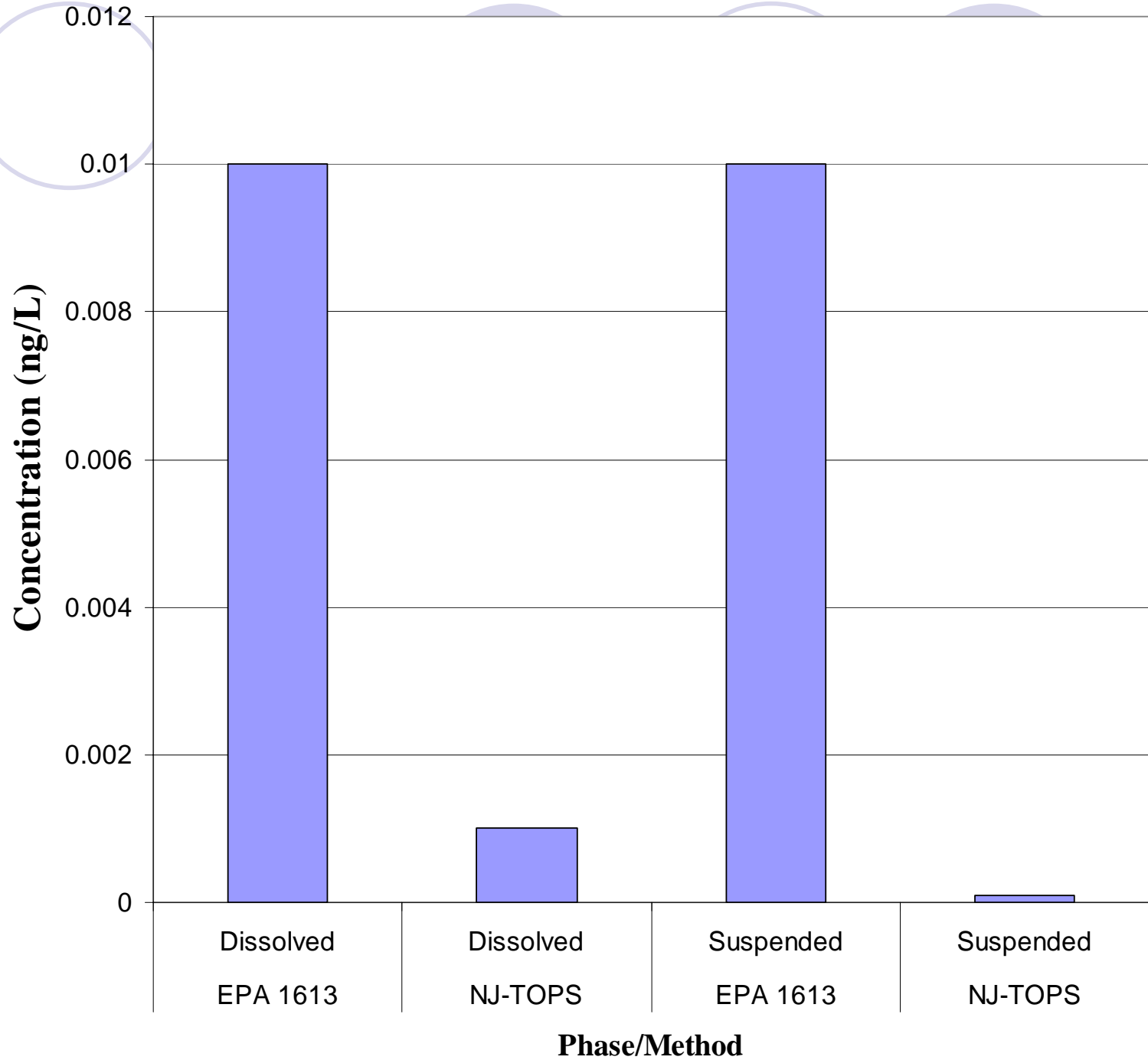
# Laboratory Analysis – Extraction, Cleanup, Concentration, GC/MS





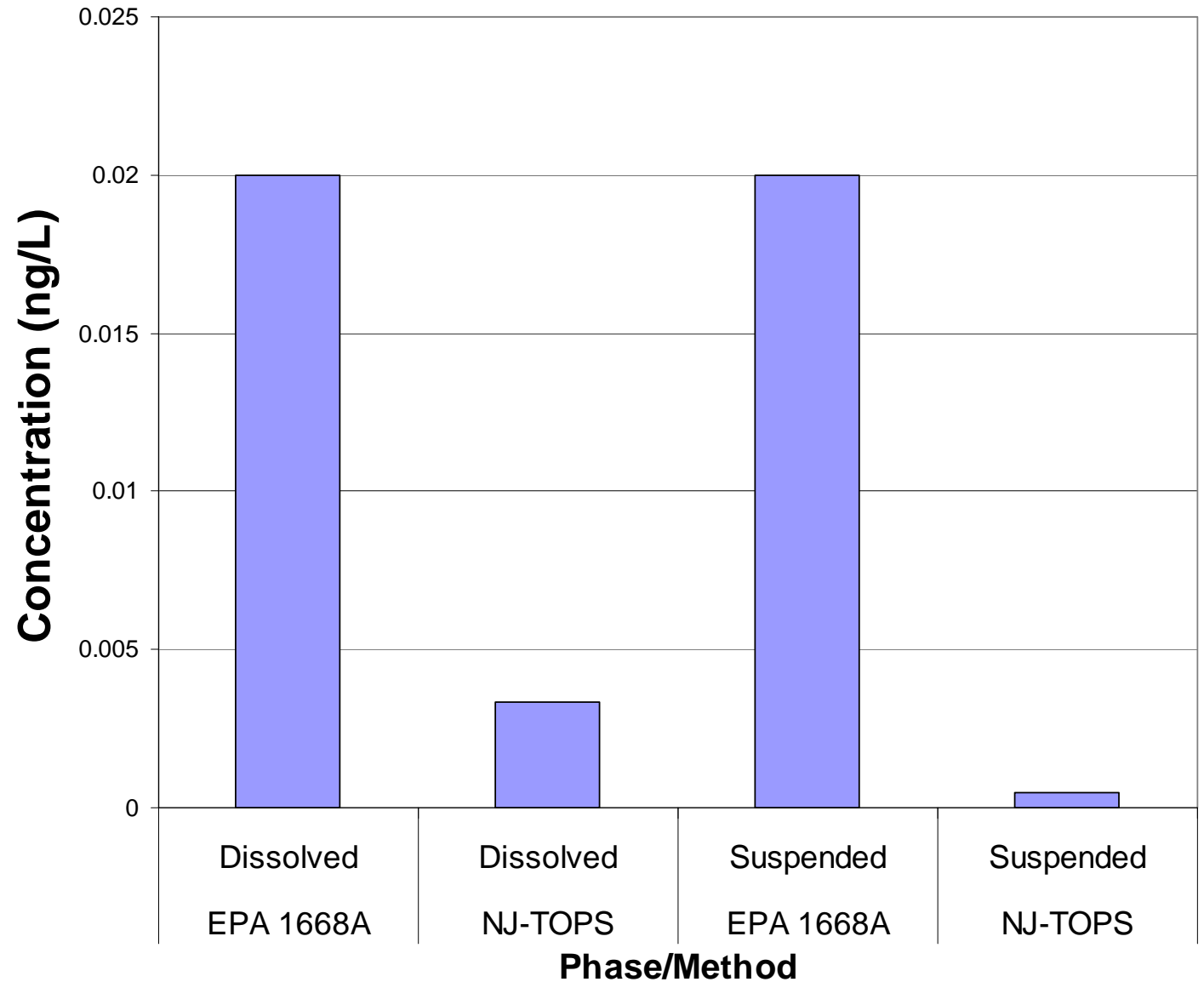
Low  
Calibration  
Level (LCL)  
for TOPS  
versus  
Traditional 1 L  
Grab Sample

Dioxins &  
Furans



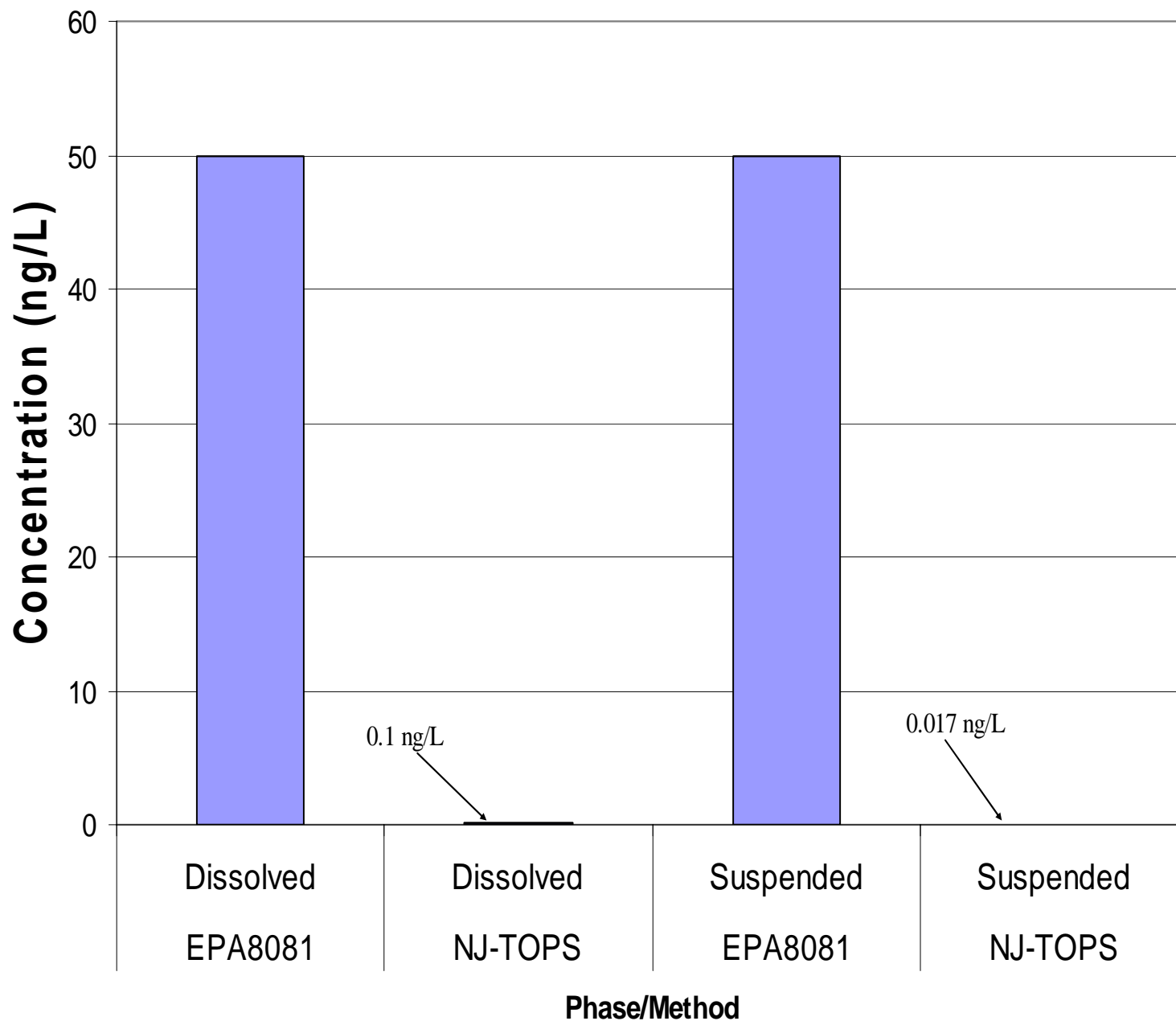
# PCB Congeners

LCL for  
TOPS  
versus 1L  
Grab  
Sample



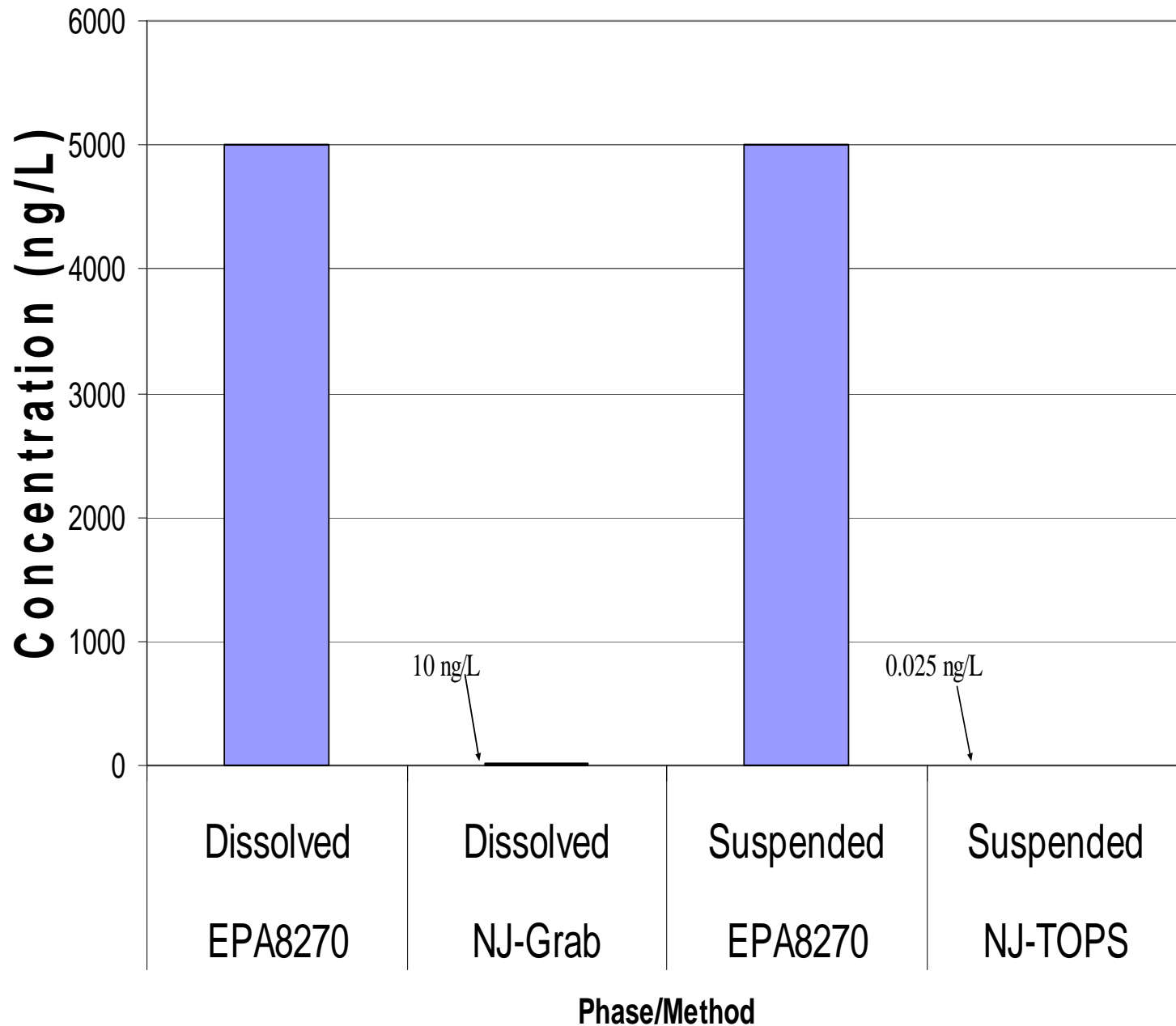
# OC Pesticides

LCL for  
TOPS-HRMS  
versus 1L  
Grab Sample-  
8081



PAHs

LCL for  
NY/NJ  
Protocol 1L  
Grab  
versus 8270  
(Dissolved)  
& 1L vs  
TOPS  
(Suspended)





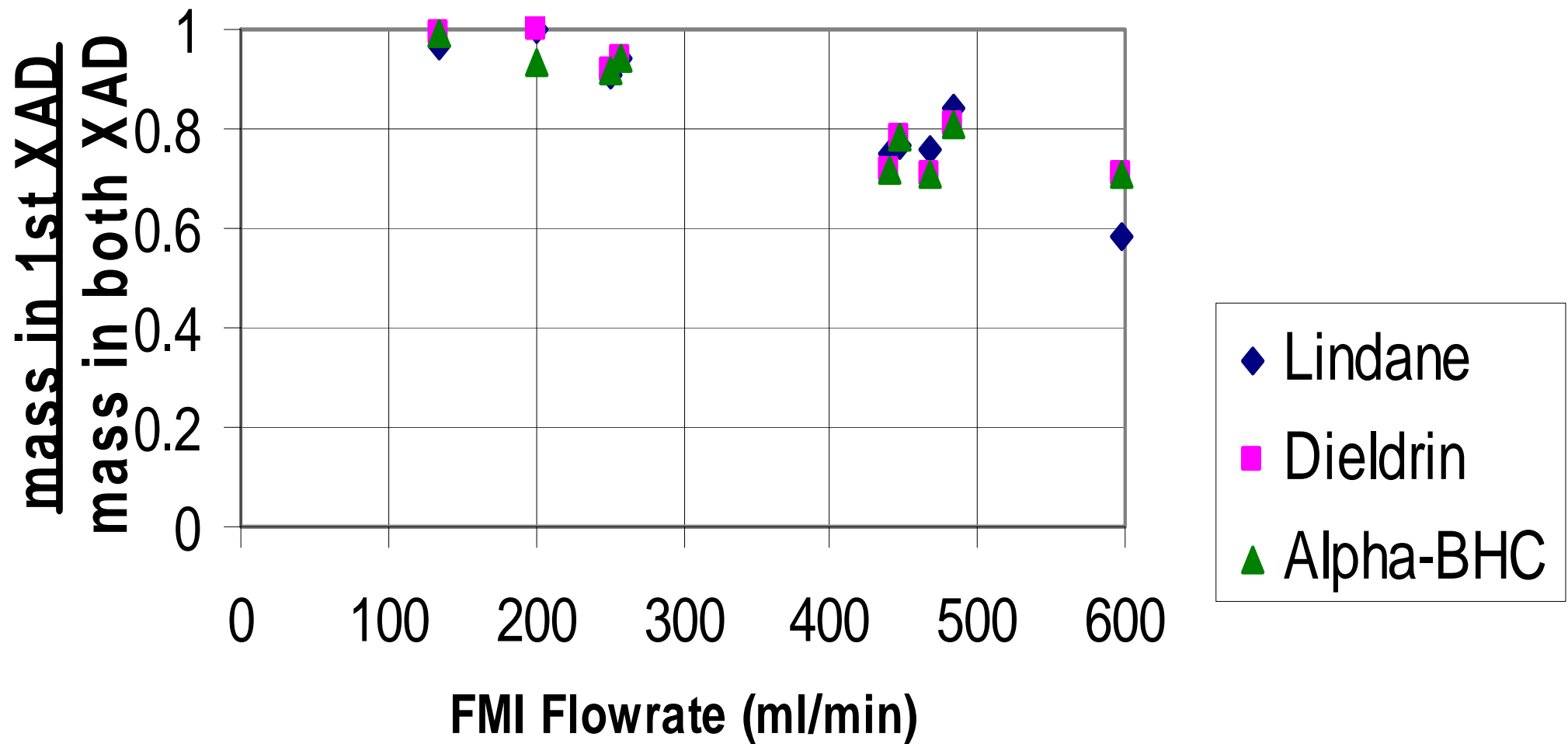
***Recovery of NIST SRMs from XAD resin***  
***Typical time between spiking and analysis = 7 to 30 days***

Analyte Class	Spiking Medium	Spike Levels ng/sample	Certified Analytes	Lowest Recovery	Highest Recovery	Average Recovery
OC Pesticides	XAD	1-5	14	66	130	88.4
PCBs	XAD	20-50	23	82	157	102
Dioxins	XAD	1	1	111		

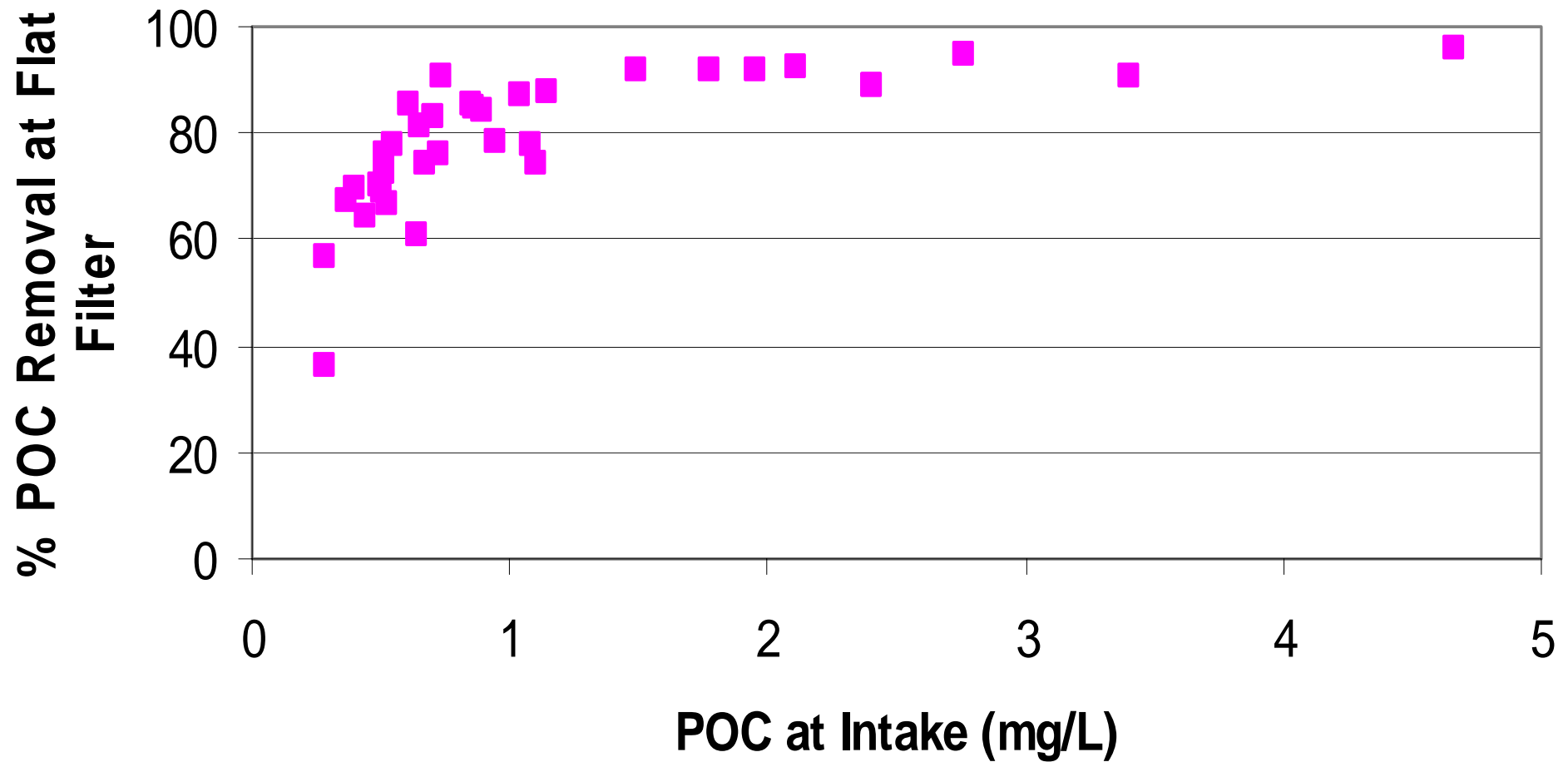
**Recoveries of NIST PAH SRM from Water**

PAHs	Water	100-500	22	78	133	101
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## Pesticide Data FMI flowrate vs. Breakthrough



## POC Removal at Flat Filter



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***How low can we measure? Example - PCB Congener EDLs***  
(EDL = Concentration associated with a peak at 2.5 X noise, during analysis.)

Range of values observed in this work:

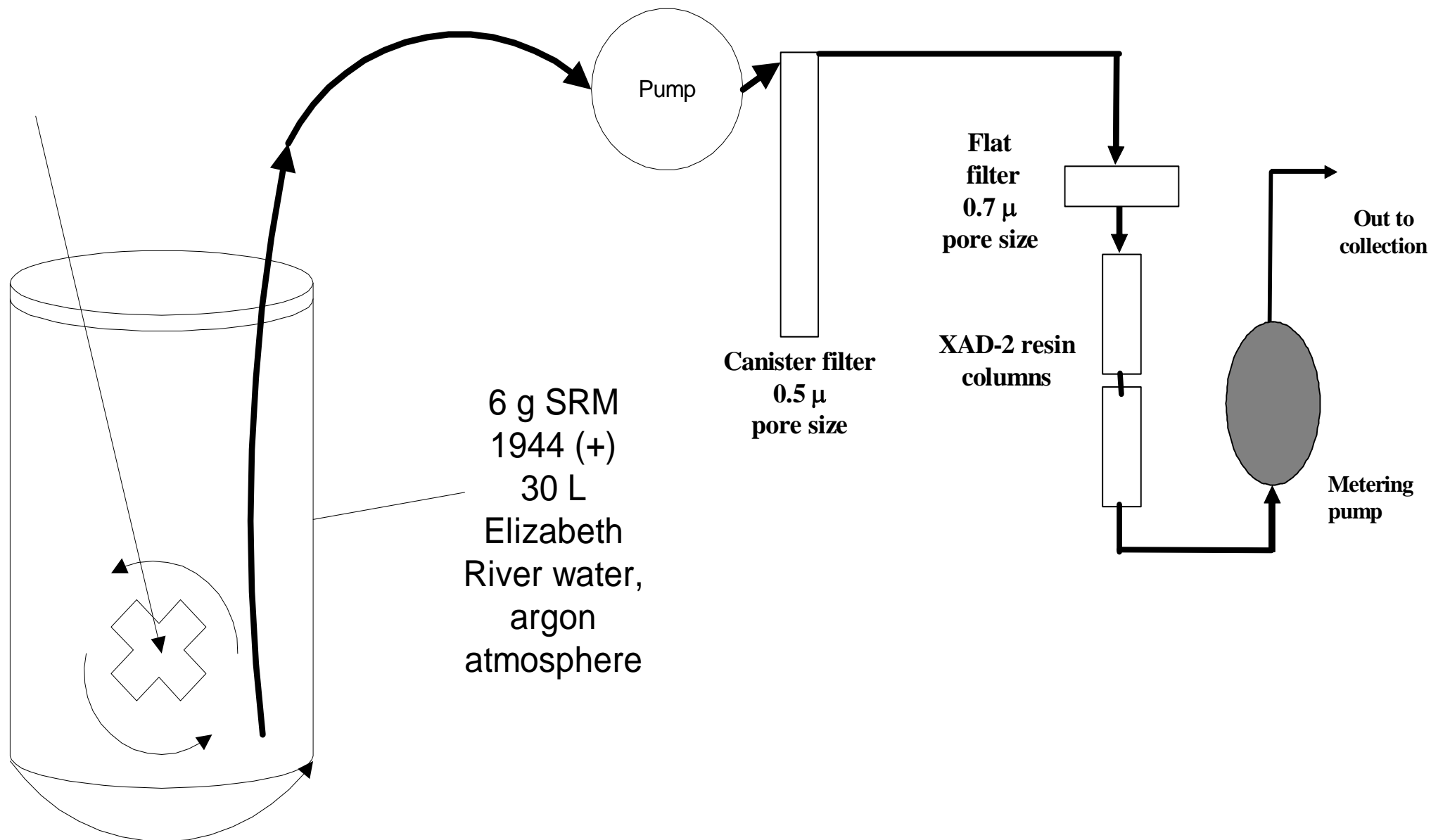
- Dissolved (XAD) = 15 to 450 pg (**0.3 to 9 pg/L** for 50 L sample)
- Filters = 25 to 550 pg (8 to 180 pg/g for 3 gram sample) **For a 500 L sample at 6 mg/L, 0.016 to 0.36 pg/L**

**This assumes that 100% of contaminants entering the sampler are trapped by the filters and XAD, AND recovered through analysis.**

**An evaluation of sampling & analysis validity was performed by spiking river water with NIST sediment and liquid SRMs.**

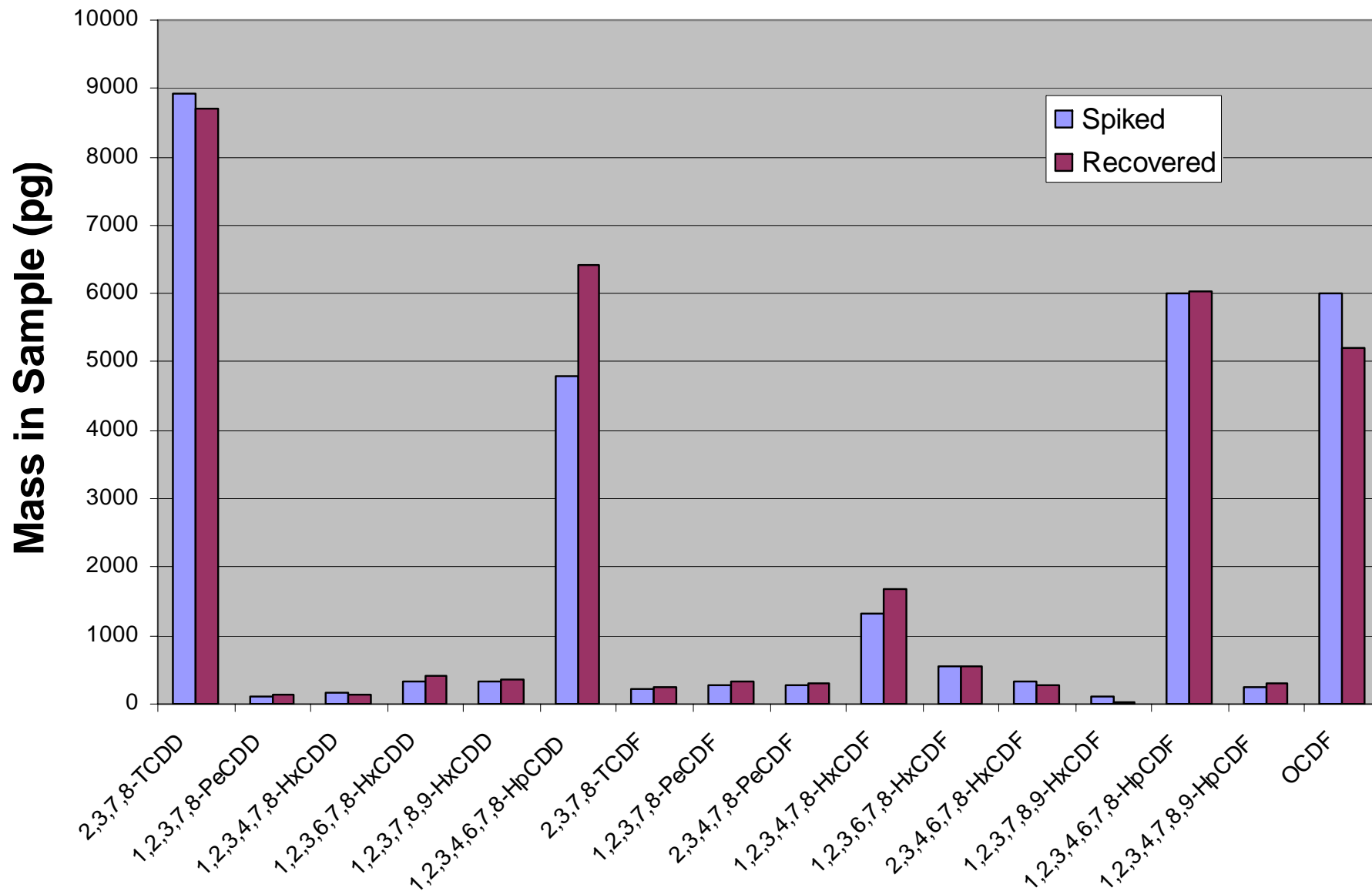
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# Validation Study - Apparatus

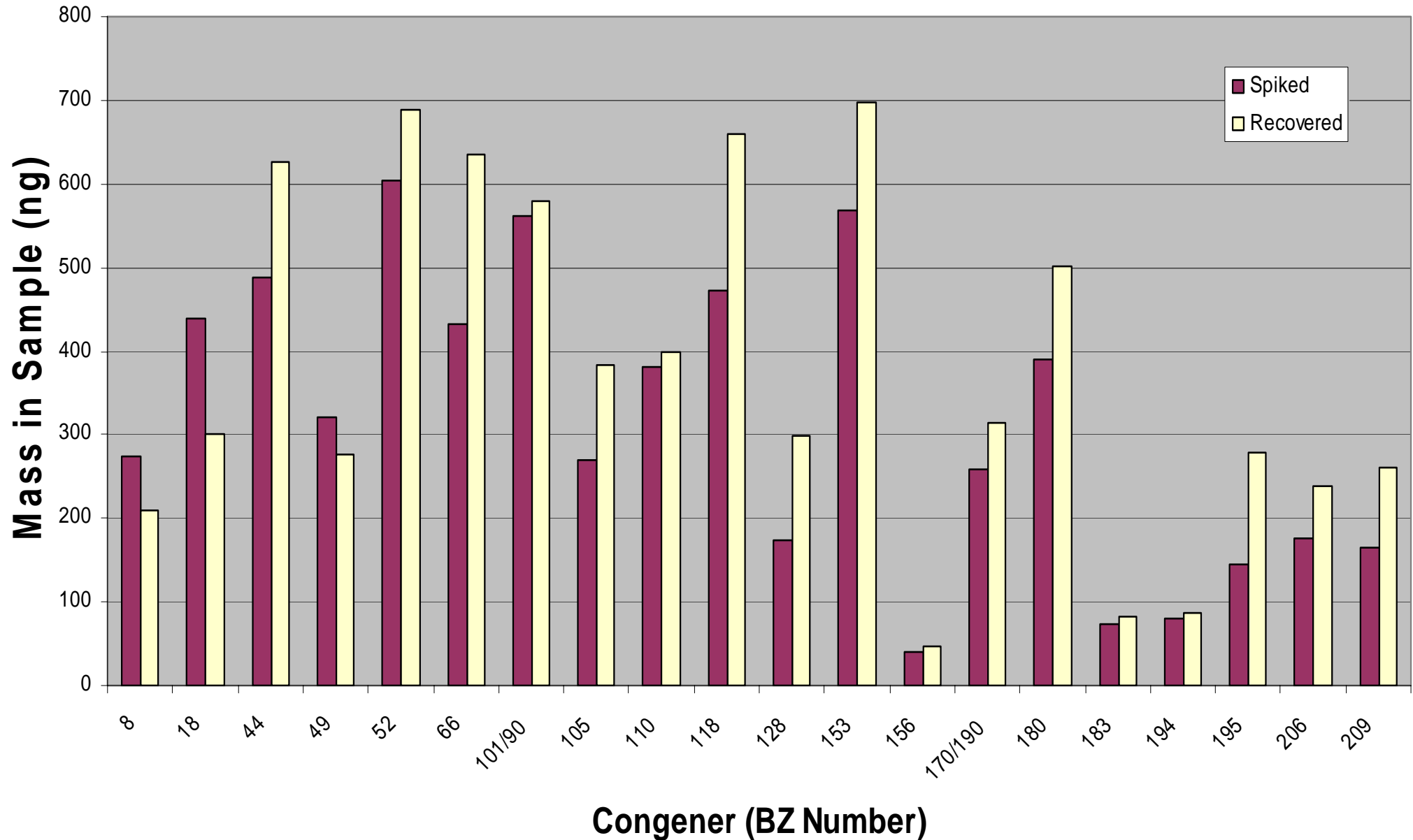


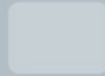
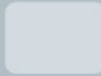
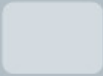


## Sampling & Analysis Validation - Dioxins & Furans



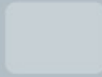
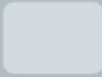
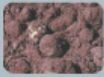
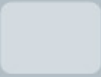
# Sampling & Analysis Validation PCBs



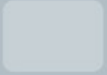
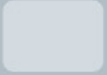
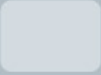


## Leaders in Environmental Testing

- Operating limits were determined for flow rate, filter configuration, minimum POC, XAD bed volume.
- Calibration range for all compound classes were reduced by 1-4 orders of magnitude below EPA Methods.
- Measured detection limits (EDLs) have been demonstrated at ppq and sub-ppq levels for POPs.
- Laboratory analysis precision and recovery have been demonstrated by SRM analysis. (PAHs, PCBs, OCPs, TCDD).
- Sampling and analysis accuracy has been demonstrated by SRM analysis (PCDD/Fs, PCBs). PAH data is in progress.
- TOPs met program goals for PCDD/F, PCB, PAH (sediments). OCP data not yet evaluated.



- **Timothy Wilson, Jennifer Bonin– USGS, Trenton, NJ**
- **David McNeil, Snell Mills – STL Knoxville Specialties Staff**
- **Joel Pecchioli – New Jersey DEP, Trenton, NJ**
- **Tsian Liang Su - Stevens Institute – Rutgers University**
- **Simon Litten, Larry Bailey - New York DEC, Albany NY**



# more information...

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